Meetings

Intrauterine Devices

Intrauterine devices (IUD's) provide a particularly satisfactory method of fertility regulation. They are inexpensive to manufacture, easy to distribute, and require only one decision for use—that of having the device inserted. Furthermore, they have proved remarkably safe and acceptably effective. For these reasons, IUD's have been adopted for a number of programs of family planning. It is estimated that 3 million of the devices are in use, although this is only a rough calculation because there is no accurate way to measure this number. Approximately 1.3 million are being used in India (largely since April 1966); in the United States about 1 million are now in use.

Despite carefully designed studies of the safety and efficacy of IUD's, their precise mode of action in humans is not known. Research over a number of years has shown that foreign bodies in the uterus control fertility in different ways in different species. To discuss recent findings in this field, a meeting on the comparative biological effects of intrauterine devices was held in Bethesda, Maryland, 4–6 January 1967, under the auspices of the National Institute of Child Health and Human Development of the Public Health Service. Participants included reproductive physiologists, veterinarians, and physicians, all of whom had conducted investigations on the effects of intrauterine devices in various species including the fowl, mouse, rat, rabbit, guinea pig, goat, sheep, pig, cow, water buffalo, monkey, and human.

The meeting revealed that no general statement on the mechanism of action could be formulated, except that intrauterine devices have an antifertility effect in all species tested. The devices under discussion were quite different in composition and form. The IUD's used in humans and other primates are generally composed of polyethylene or stainless steel and have such shapes as loops, coils, bows, and rings. Devices for use in other animals necessarily have different shapes because such animals have bicornuate uteri. Thus, for large domestic animals, such as sheep and cattle, the IUD's are spirals of polyethylene; and for smaller animals, such as rodents and rabbits, they may be threads of silk or nylon as well as spirals of polyethylene. Glass beads are also used. The importance of these differences in composition and structure, as well as the presence or absence of uterine distension which the devices may cause, has not been made clear.

So far the only systemic effects of IUD's noted are on the anterior pituitary and the ovary. Changes in follicle-stimulating and luteotrophic hormones have not been measured. The IUD's appear to decrease the amount of secretion of luteinizing hormone in the sheep and rabbit; this effect is not seen in humans. The IUD's have no effect on oxytocin release in rats but may increase this activity in humans.

That intrauterine devices inhibit ovulation in the water buffalo has not been confirmed and is not seen in other animals. The period of corpus luteum function is decreased in the guinea pig, sheep, pig, and cow, but this effect is thought to be local, because in most of these species such diminished function is limited to the side on which the IUD is inserted.

Ovum transport through the oviduct is not affected by the IUD in the rat, rabbit, and sheep. It is depressed in the chicken and mouse. In the monkey, the rate of ovum passage is increased in superovulated animals with IUD's; this finding is responsible for the most widely suggested mechanism of action of IUD's in humans: acceleration of ovum transport. It is clear, however, that the experimentation with monkeys must be continued and must be extended to humans.

Sperm transport is not affected in most species, with the exception of sheep where no viable sperm are found in the oviduct of IUD-bearing animals; this is a unilateral effect. If sperm are injected into the uterus of such animals, the sperm are decapitated.

Fertilization is not affected by IUD's in rodents and cattle; it is prevented in sheep. In cows, fertilization by artificial insemination is inhibited by IUD's. Such inhibition does not occur with natural mating, a finding of unknown significance. The effect of IUD's on fertilization of primates is not known, although the diminished rate of tubal pregnancies in human females with IUD's suggests that a reduced incidence of fertilization cannot be precluded.

The IUD's have a uterotropic effect in some animals; in some, they produce chronic local infection. In all animals examined, polymorphonuclear leukocytes are invariably found in tissues adjacent to the IUD. The significance of this finding is not known. However, it is known that in humans the almost inevitable bacterial contamination of the uterine cavity which occurs with the introduction of an IUD usually clears within several weeks.

Studies of biochemical changes (brought about by IUD's) in uterine tissue have not been undertaken for all species. In the monkey and rabbit, a temporary increase in oxygen uptake in this tissue and an increase in alkaline phosphate have been detected. Numerous other substances have been measured and found not to be affected. An increase in concentration of histamine in the rat uterus with IUD use has been observed, a finding which may be related to the recent discovery in rats of an increase in mast cells in uterine tissue adjacent to the IUD.

The meeting disclosed that no major systemic effects of intrauterine devices have yet been detected, and that these devices have an antifertility effect which varies greatly in different species. In many animals IUD's have an estrogenlike effect: they increase total uterine weight, inhibit corpus luteum activity, increase uterine motility, change capillary permeability, and produce histological changes mimicking those following estrogen administration. These changes do not occur in all species, and it was not proposed that the finding of such pseudoestrogen effects lends itself to a general theory of IUD action. Certainly IUD's have proved to be a unique biological tool and have aided considerably in the understanding of processes of reproduction, but much more careful investigation must be carried out before the mechanism of their action is fully understood.

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Thermoluminescence of Geological Materials

Investigations of the thermoluminescence of geological materials have been carried on by geologists and others for several decades. Detailed studies of the phenomenon were only begun about 20 years ago by Farrington Daniels and his associates at the University of Wisconsin. Since that time, several widely separated groups of investigators have continued research on the subject. In order to allow North American, European, and Asian researchers to meet and exchange information on current developments in the field, the 1st International Symposium on Applications of Thermoluminescence to Geological Problems, was held in Spoleto, Italy, 5–6 September 1966. Participants included geologists, archeologists, physicists, chemists, and astronomers from Austria, Belgium, Canada, Denmark, England, France, Germany, Greece, India, Italy, Japan, Malaysia, Mexico, Switzerland, Thailand, the United States, and Venezuela. Sixty-five papers were presented covering all aspects of thermoluminescence investigations as well as such related phenomena as electron spin resonance and exoelectron emission.

Farrington Daniels opened the technical program with a review of the pioneering work of such investigators as Lind, Wick, Urbach, Randall, and Wilkins, and the studies carried out at the University of Wisconsin between 1946 and 1959.

Thermoluminescence radiation dosimetry is a recently developed medical technique by which the thermoluminescent response of irradiated crystalline materials, such as LiF, can be utilized as a means of measuring the amount of radiation received by the crystals. The application of the principles of thermoluminescence radiation dosimetry to determine the radiation conditions of a sedimentary environment, the measurement of very low radioactivity of geological and archeological samples, geothermometry, paleoclimates, and sedimentary transport was the subject of several papers.

One of the earliest applications of thermoluminescence to geological problems has been the attempt to determine the age of carbonate rocks by using either radiation damage or dosimetry methods. This subject received considerable attention, both from the theoretical and applied points of view. Attempts to apply similar techniques to the dating of ancient pottery, meteorites, recent lava flows, and orogenic events were described.

In addition to radioactivity, several factors may influence the thermoluminescent response of geological materials; such factors include: pressure, mineralogy, trace element content, temperature of formation, polymorphic phase transitions, and adsorbed gases. These were considered, both from the point of view of "spurious" thermoluminescence, which may cause problems in investigations of age determination, and as direct applications in investigations of rock mechanics and the search for mineral deposits.

With the objectives of maintaining the exchange of information between laboratories and promoting further research in thermoluminescence of geological materials, several committees were appointed: International Symposium on Thermoluminescence of Geological Material (1969), E. Tongiorgi (Laboratorio di Geologia Nucleare, Pisa, Italy) and D. J. McDougall (Loyola College, Montreal, Canada); Committee on Thermoluminescence Standards, D. R. Lewis (Shell Development Co., Houston, Texas) and J. Kaufhold (Universität zü Koln, Koln, Germany); Bibliography, Norbert Grögler (Universität Bern, Bern, Switzerland); Liaison between Laboratories, Edward Zeller (University of Kansas, Lawrence).

Laboratories or individuals who would like to be kept advised of the work of these committees should contact E. Tongiorgi or D. J. McDougall. Support for the meeting was provided by NATO; the U.S. Air Force; the National Research Council of Canada; the United States National Science Foundation; Loyola College, Montreal, Canada; and the Laboratorio di Geologia Nucleare, University of Pisa, Italy. Proceedings of the meeting will be published by Academic Press, London, probably in mid-1967.

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Stereology

"Universities have departments of various disciplines. But nature knows of no departments. It is one indivisible whole." This statement made by Buckminster Fuller in the opening session of the Second International Congress for Stereology (8–13 April 1967, Chicago, Illinois) characterizes the spirit and work of the Congress.

Scientists from various disciplines and countries discussed problems which they all have in common. Problems of structure common to astronomy, ceramics, geology, metallurgy, anatomy, botany, cytology embryology, neurology, pathology and zoology were attacked with the methods of conventional geometry, integral geometry, and topology. Aspects of instrumentation formed an integral part of the program.

Stereology in the strict sense is defined as three-dimensional interpretation of flat images. These images may be sections or projections. The internal structure of complex solids can be studied, without disturbing the dimensions and mutual relationship of parts, by sectioning. The flat images with which metallurgists are confronted are planes of polish. These are true mathematical planes without any thickness. In the life and earth sciences, we deal with translucent slices of finite thickness. In astronomy and cosmology we are confronted with images which in essence are projections of objects on a sphere circumscribed around the observer.

In all these cases, direct access to the objects to be studied is impossible, be they metallic or mineral particles, components of living tissues or galaxies. Their visible images do not give direct information on many aspects of their three-dimensional structure, orientation, or mutual relation. We are dealing in these cases with uniaxial viewing.

In order to obtain the desired information we must extrapolate from two- to three- dimensional space. The procedures involve measurements of lines as well as counts of points or profiles in grids superimposed on the plane of observation. In most cases the algebraic formulas, often found independently with much labor by several investigators who did not know of each other's work, are astonishingly simple.

For example, the total length of a system of lines per unit volume is represented by $L_V = 2\bar{P}_A$, where $\bar{P}_A$ is the average number of intersections of those lines with the test area A in the sections. The equation for the total